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Submitted by:

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The research objectives of this grant are to perform research in the general area of ionospheric plasmas — utilizing data made available by the Goddard Space Flight Center. The first program undertaken was the analysis of an anomaly in the current response of a cylindrical Langmuir probe carried aboard Explorer XVII. We believe that this results from an end-effect which is important when the probe axis is aligned with the vehicle velocity vector. This problem has been theoretically developed, and the paper detailing these results is in preparation. The theory is presently being compared with the experimental evidence, and it is hoped that these results will be complete in the near future. Several important possibilities have evolved from this work. First, the width of this anomalous current peak is a sensitive function of the ion temperature and is, therefore, a promising technique for accurately measuring this parameter on rapidly moving vehicles. Another possible application is the use of this current peak for the measurement of the velocity vector orientation with a high degree of accuracy.

Another program being actively pursued is a comparison between the characteristics of cylindrical Langmuir probes, of the type carried on Explorers XVII and XXII, with theory attempting to account for all observed phenomenon with the view to evaluating the accuracy of the probe under given conditions. An outgrowth of these studies is the development of new data analysis techniques which will allow one to minimize or eliminate the errors inherent in the measurement. These results, while still tenative, appear very promising.

Two other programs which are just now getting underway involved analysis of the volt-ampere characteristics of a moving cylindrical Langmuir

probe for ion mass. The theory indicated that it should be possible to resolve a two component system and determine the mass numbers and relative density of the constituents. Also, a program to study the wake structure of a moving statellite utilizing data from the cylindrical electrostatic probe of Explorer XVII and XXII is now in its preliminary stages with no tangible results as yet available.